

REMARKS

Claims 1-20, 41, 46, 48, 80, 81, 83, 87 and 89 have been cancelled and claims 21-36, 47, 49-77, 88, and 90-103 have been withdrawn; thus claims 37-40, 42-45, 78, 79, 82, 84, 85, and 86 remain pending for consideration.

Objections to Drawings

The drawings are objected to on the basis that a gravity settler as recited in claims 48 and 89 are not shown in the drawings. In response, rather than amending the drawings, Applicant has simply cancelled claims 48 and 89. By this amendment, however, Applicant is not in any way narrowing the scope of the claimed invention. In particular, the separating limitation in claims 37 and 78 may be carried out by a variety of different types of separators—including gravity settlers—without departing from the scope of claims 37 and 78.

Rejections Under 35 U.S.C. §112

Claims 37-46, 48, 78-87 and 89 stand rejected on the basis that the claims fail to comply with the written description requirement. Although Applicant disagrees and submits the application as filed does convey that Applicant had possession of the claimed invention, to more quickly advance prosecution, Applicant has amended independent claims 37 and 78 to include language that is clearly supported by the specification. For example, claims 37 and 78 have been amended to recite monovalent and multivalent instead of undesirable and desirable, respectively. Support for the amendments is found, at least, at paragraphs [0003], [0004], and [0008] and cancelled claim 7.

In addition, claim 37 has been amended to recite in part:

removing ~~undesirable~~ monovalent components from the contaminated water with ~~a~~ the purifying material to generate treated water, wherein the treated water includes ~~desirable~~ multivalent components, and wherein the purifying material attracts both the ~~undesirable~~ monovalent and ~~desirable~~ multivalent components;

controlling an amount of time the purifying material and the contaminated water are mixed together so as to allow preferential removal of the monovalent components; and

separating the purifying material from the treated water. before substantial amounts of the desirable components are removed from the treated water.

Support for this amendment is found, at least, at paragraphs: [0009], [0015], [0016], [0021], [0031], and as a consequence, Applicant respectfully requests that the rejection be removed.

With respect to independent claim 78, it has been amended to recite in part:

receiving the contaminated water;
 mixing the contaminated water with a purifying material, wherein the purifying material is adapted to combine with ~~undesirable~~ monovalent components from the contaminated water so as to generate treated water;
cocurrently transporting both the purifying material and the contaminated water to a separator while the purifying material combines with the monovalent components ~~continuously varying an amount of purifying material mixed with the contaminated water so as to continuously vary the amount of undesirable components removed from the contaminated water;~~
controlling a duration of contact between the contaminated water and the purifying material so as to selectively remove the monovalent components from the contaminated water; and
 separating the purifying material from the treated water.

Support for this amendment is found, at least, at FIGS. 1 and 2; cancelled claims 80 and 81 and paragraphs: [0021], [0008], [0009], [0016], [0021], [0022], [0028], [0031] and [0032]. For example, both FIGS. 1 and 2 both show exemplary embodiments that carry out cocurrent transportation of contaminated water and purifying material to a separator 16. Applicant respectfully requests that the rejection be removed in light of these amendments.

With respect to dependent claim 41, it has been cancelled merely to expedite prosecution of the application, and Applicant submits it is abundantly clear to one of ordinary skill in the art--in light of the specification--that in many embodiments of the claimed invention, some undesirable components (e.g., monovalent components) may remain in the treated water.

Claim 82 has also been amended, to require that the separating occur while the purifying material is partially loaded ~~before a substantial amount of desirable components are removed from the treated water~~. Support for this amendment is found, at least, at canceled claim 6.

Applicant also submits that it is abundantly clear throughout the specification that, in many embodiments, that separation occurs before a substantial amount of desirable components are removed from the treated water. For example, the specification is very clear that some embodiments of the present invention “will allow preferential removal of monovalent cations from solutions containing both monovalent and divalent cations, when using commercially available ion exchange media that exhibits selectivity for divalent cations.” (See, e.g., Para. [0009]). Although the cancellation of claim 82 and amendment of claim 37 render the written description issue moot, Applicant is in no way acquiescing to the written description rejections and preserves the right to pursue the subject matter that is objected to in the Office Action in one or more continuing applications.

Rejections Under 35 U.S.C. §102 and §103(a)

Claims 78-81, 84-87, and 89 stand rejected on the basis that the subject matter of these claims is anticipated by US 3,679,581 (“Kunz”). And claims 37-46, 48, 82, and 83 stand rejected on the basis that Kunz in view of the “Encyclopedia of Separation Technology” renders the subject matter of these claims obvious.

As discussed, Applicant has amended claim 37 and 78, but it is helpful to first understand the apparatus disclosed by Kunz to appreciate why the amendments clarify distinctions between the claimed invention and Kunz’ teaching. As described in the ‘581 patent, Kunz uses a complex multi-stage exchange column 1 that is “only [] effective” by virtue of having “relatively small steps or levels” to contact ion exchange material with raw water (See Kunz, Col. 2, lines 11-18). In particular, raw water “rises slowly upwardly to the head 50 of the exchange column 1” through each of the steps or stages 10, 11, 12 and 13 in a countercurrent flow relative to Kunz’

exchange material, which moves downward in the “column 1 into the counter pressure chambers 18, 19” (Kunz Col. 3, lines 45-70; and Kunz Col. 1, lines 33-37).

Because Kunz’ method and apparatus requires the exchange material to flow in an opposite direction as their raw water, Kunz’ method and apparatus is severely limited in terms of the extent that the flow of their raw water may be controlled. In particular, to maintain counter flow between their raw water and the exchange material in their chamber 1, Kunz must limit the superficial velocity in the exchange column 1 to a value well below the elutriation velocity of their exchange material. As a consequence, Kunz simply does not, and can not, teach any meaningful control over the rate of their raw water flow and/or the time their raw water is exposed to their exchange media. Thus it is not surprising that Kunz only discloses that their raw water moves “slowly” until the water arrives at the head of Kunz’ column 1.

Nor does Kunz teach that there is any reason to control the flow rate of their raw water. Instead, Kunz teaches that raw water may be completely desalted by using the multi-stage column 1 in connection with two separate exchange-material circulatory systems: one to remove anions and the other to remove cations. And as a consequence, in Kunz’ system it is “necessary” that two regeneration columns 2, 3 be employed to accommodate the two distinct exchange material systems (See Kunz, Col. 3, lines 8-13). To be more specific, Kunz teaches that one of the exchange material systems feeds two stages 10, 12 with exchange material that allegedly removes all cations from the raw water (e.g., Ca, Mg, K and Na) and another exchange material system that feeds two other stages 11, 13 removes all anions from the raw water (e.g., Cl, SO₄, CO₃, HCO₃). Thus, Kunz teaches that raw water can be completely desalted using multiple discrete stages in its exchange column 1 and two separate exchange material circuits to remove the anions and cations from the raw water.

In short, Kunz teaches a system which purportedly converts raw water to a completely desalted condition by slowly moving the raw water in a countercurrent direction to exchange material through a complex column 1 of multiple stages 10, 11, 12, 13, which is fed by two separate exchange-material circulatory systems: one that removes anions and another that removes cations.

In contrast to Kunz' method, which passes exchange material in countercurrent flow to raw water, amended claim 78 recites "cocurrently transporting both the purifying material and the contaminated water to a separator while the purifying material combines with the monovalent components." As discussed, exchange material in Kunz' apparatus is not cocurrently transported with raw water at all. Instead Kunz' raw water slowly rises to the top of Kunz' column and Kunz' exchange material falls to the bottom of Kunz' column 1.

In addition, amended claim 78 also recites "controlling a duration of contact between the contaminated water and the purifying material so as to selectively remove the monovalent components from the contaminated water." As outlined above, Kunz does not teach any control over the duration of their exchange media and raw water—instead the raw water slowly moves to the top of Kunz column. Moreover, Kunz does not teach selectively removing monovalent components from the contaminated water—instead cations and anions are removed entirely. And finally, Kunz clearly does not teach selective removal of monovalent components by controlling a duration of contact between Kunz exchange material and raw water. As a consequence, Applicant submits claim 78 is new, nonobvious, and in condition for allowance, and respectfully requests favorable reconsideration of claim 78 and dependent claims 79, 82, 84, 85, 86.

Although claim 78 has been amended, it is important to note that, contrary to what is stated in the Office Action, Kunz simply does not teach nor suggest "continuously varying an

amount of purifying material mixed with the contaminated water so as to continuously vary the amount of undesirable components removed from the contaminated water.”

With respect to amended independent claim 37, it recites “controlling an amount of time the purifying material and the contaminated water are mixed together so as to allow preferential removal of the monovalent components.” Again, Kunz does not teach the ability to control an amount of time their exchange material is exposed to the raw water. Moreover, Kunz does not teach preferential removal of monovalent components at all—Kunz removes all anions and cations. Thus Applicant submits claim 37 and dependent claims 38-40 and 42-45 are new, nonobvious and in condition for allowance.

Finally, the Office Action contends it would be obvious to modify the process of Kunz in light of teachings from the Encyclopedia of Separation Technology. First, Applicant submits modifying the functionality of Kunz as the Office Action suggests would render Kunz apparatus inoperable for its intended purpose of removing all anions and cations from raw water (See Kunz, Col. 1, lines 53-56; and Col. 2, lines 1-10). Moreover, the Office Action fails to disclose how Kunz could possibly be modified to operate in a manner that would enable the separation of purifying material from the treated water before substantial amounts of desirable components are removed from the water, and Applicant submits Kunz’ apparatus can not be modified as suggested by the Office Action. And with respect to amended claim 37, Applicant respectfully requests that the rejection be removed or evidence (e.g., an affidavit) be presented that details how Kunz process/apparatus could be modified to successfully control an amount of time the purifying material and the contaminated water are mixed together so as to allow preferential removal of the monovalent components.

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The bottom line is, Kunz teaches a very different system that is not intended to provide preferential or selective removal of monovalent components from contaminated water. Nor is Kunz capable of being modified to successfully operate within the scope of any of the pending claims. For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Applicants have made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Sean R. O'Dowd, Applicants' Attorney at 303-625-1013 so that such issues may be resolved as expeditiously as possible.

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